Western Regional Planning Panel (WRPP)

Submission from

Dubbo Regional Council

Regarding

2016WES006 – Dubbo - PP_2016_DUBBO_005_00 "Daisy Hill"

Date – 16 August, 2019

BACKGROUND

The Daisy Hill Planning Proposal was initially lodged with Dubbo City Council on 25 October 2013. Since that time the proponent and Council have attempted to resolve a number of outstanding issues in relation to the proposal. The principal outstanding issue for Council remains the significant issue of potential Salinity impacts, particularly downstream in the Troy Gully and Eastridge residential environments.

In 2015 a report to Council noted "the report presents an unacceptable groundwater and salinity impact to both future residential development on the subject land and further development downstream in the Troy Creek catchment area."

This remains the position of Dubbo Regional Council.

In response, the Western Regional Planning Panel (WRPP) endorsed an independent review of the proponents' plans and Salinity Management Strategy prepared by EnviroWest, this was undertaken by EMM Consultants.

The proponent also commissioned a review of the Salinity Strategy prepared by EnviroWest. This report was completed by SoilWater Consultants and concurred with the EnviroWest study.

On 19 March 2019 the WRPP published their latest determination in relation to the subject Planning Proposal. Dot point 2 of the Panel Decision is as follows:

- *Delete Condition 2 and replace with:*

  Prior to community consultation, a Salinity Management Strategy is to be prepared for the site in consultation with Dubbo Regional Council and the Department of Primary Industries. The Strategy shall include agreed;

  - *Success criteria*
  - *Range of scenarios to be modelled*
  - *Modelling methodology*
  - *Format for the presentation of results*

  The Strategy shall address salinity management on the site as well as potential downstream impacts on the Troy Gully catchment and demonstrate that the proposed type, layout and density of development will not have a significant impact on downstream salinity. The strategy is to be submitted to the Panel to form part of the community consultation package.

It appears from a review of the information placed on public display that a draft Salinity Management Strategy has not been prepared, despite the provision of such Strategy being clearly required by condition 2 of the WRPP determination.

A draft salinity management strategy was prepared in 2015. This Strategy was not considered adequate or accurate. A subsequent redraft dated November 2018 was

completed without Council involvement, and remains inadequate and incomplete. It appears that the Proponent and the WRPP is relying on information addressing the strategic impacts and management of salinity on the subject land across a number of separate documents and not a stand-alone Strategy prepared in accordance with Condition 2 of the determination of the WRPP.

Despite not being prepared in consultation with Council, not including any agreement on the above required dot points and remaining inadequate and incomplete, it appears that the Panel determined on 9 June 2019 that the salinity management strategy was sufficient and community consultation could occur.

Council was provided 30 days and one (1) complete set of documents for both internal review and public display.

As a result of the short time frame and sheer scale of salinity related documentation Council engaged Sustainable Soil Management (SSM) to review all relevant information pertaining to salinity management at the proposed Daisy Hill development.

SSM examined the following documents in order to prepare their report;

- EnviroWest Consulting 10/8/2017 "Updated groundwater and salinity study: Daisy Hill Estate"
- EnviroWest Consulting 12/12/2017 "Hydraulic model simulation for Daisy Hill"
- SoilWater Consultants 16/4/2018 "Daisy Hill groundwater an salinity study peer review"
- EnviroWest Consulting 18/4/2018 "Additional groundwater information Daisy Hill"
- EMM 14/6/2018 "Independent review of Daisy Hill groundwater and salinity modelling"
- EnviroWest Consulting 1/11/2028 Salinity management strategy Daisy Hill residential estate"
- SoilWater Consultants 14/2/2019 "Vegetation plan (VMP) for the Daisy Hill subdivision"

The SSM Report forms the bulk of the following submission and is provided attached here in **Appendix 1**.

SUBMISSION

1. SALINITY

The attached SSM document is a succinct summary of the afore-mentioned seven (7 documents and reaches the following principle conclusions;

- Contrasting EnviroWest and other documents portray the current salinity impacted areas at Daisy Hill as between 3% and 25% of the land area. SSM found the 25% figure more likely.
- This 25% of the site has low to moderate saline soils, groundwater levels of between 1.4m and 5.6m and highly saline groundwater. The Dubbo Regional Council (DRC) Salinity Hazard tables (below, drawn from Impax, 2013) identify Standing Water Level (SWL) and Electrical Conductivity (salinity) classes of groundwater, combining those classifications to form a Salinity Hazard. These tables clearly demonstrate that Salinity Hazard over the identified 25% of Daisy Hill is between Extreme and Medium Concern.

SWL – Salinity Risk		**EC (dS/m) – Salinity Class**	
0 – 2m	High Risk	>15 dS/m	Extreme Salinity
2.01 – 5m	Moderate Risk	6.01-15 dS/m	High Salinity
5.01 – 10m	Low Risk	2.01-6 dS/m	Moderate Salinity
>10m	Minimal Risk	0-2 dS/m	Low Salinity

SWL – Salinity Risk	EC (dS/m) Salinity Class	Salinity Hazard
High	Extreme	Extreme Concern
High	High	
Moderate	Extreme	
High	Moderate	High Concern
Moderate	High	
Low	Extreme	
High	Low	Medium Concern
Moderate	Moderate	
Low	High	
Minimal	Extreme	
Minimal	High	
Moderate	Low	Least Concern
Low	Moderate	
Low	Low	
Minimal	Moderate	
Minimal	Low	

- The Salinity Management Strategy (SMS) and Vegetation Management Plan (VMP) have the potential to produce localised improvements and mitigations of salinity on the proposed estate. These improvements will be restricted to the Daisy Hill Estate and are focused on improving intermittent shallow groundwater and waterlogging.
- The SMS and VMP have potential to positively impact the planting areas but will not address shallow groundwater issues on the proposed residential lots.
- The SMS and VMP will not impact groundwater deeper than 6m (which will move laterally downslope towards Troy Gully and Eastridge) and will not intercept shallower groundwater from laterally moving to the west (again, towards Troy Gully and Eastridge).
- The Independent Review undertaken by Consultants EMM (Department of Planning and Environment) recommended that the proposed development be staged in order to judge the success of the salinity management strategy. Given that models show the time required to reach a steady state at 16 years SSM have proposed that the period between stages be no less than 10 years to allow adequate monitoring and assessment of any impacts from each successive stage.
- It is recommended that each stage comprise no more than 10% of the proposed total lot yield.

SPECIFIC ANALYSIS

- The SSM review of the Daisy Hill Groundwater Model used by EnviroWest found;
    - Groundwater inflows comprise only rainfall, no water balancing of irrigation is offered.
    - Effluent input to the system is not modelled, despite the estate being designed without sewer infrastructure. This will be a significant unaccounted input.
    - The impact of reticulated water on irrigation levels was not calculated or modelled.
    - The area of the estate reported in EnviroWest documents varied from 430 to 380ha.
    - The EnviroWest assumptions for saturated hydraulic conductivity (Ksat), which will determine in part the speed of lateral movement through the soil, are significantly higher than both the accepted standard (Vase et al) and SoilWater in their review of EnviroWests' work. EnviroWest have calculated unrealistically high lateral transfer rates thereby impacting the accuracy of their models negatively.
    - Furthermore EnviroWest support their rapid lateral movement model by citing the presence of "thin gravel and sand bands common in the profile". Such soil structure was found in only 6 of the 28 soil logs reported, approximately 21% of the site rather than the entire site as modelled by EnviroWest.

- EnviroWest stated current recharge of 5,111 m3 differs from the sum of the recharge zones currently of 19,087 m3. EnviroWest modelling based on this error implies there will be a net post-development annual recharge at this site of -16,632 m3 without indicating the source of water which will satisfy the apparent shortfall.

- The SSM review of the Daisy Hill Salinity Model found;
  - There is a substantial discrepancy between the 3% of land area mapped as at risk in 2017 and used as the basis of modelling and the 25% identified in the Heath Consulting engineers Master Plan in 2019.
  - There is no salt balance in the model.
- SMM comments on the SoilWater review
  - SoilWater utilised accepted hydraulic conductivity standards (unlike EnviroWest) and achieved transfer rates of 1.2-2 compared with EnvironWests' findings of 2.5-5. This discrepancy was not discussed or highlighted by SoilWater but impacts the speed and efficiency of lateral groundwater movement.
  - SoilWaters' interpretation of EnviroWest data assumes no rainfall on the vegetated areas and unimpeded lateral groundwater movement at depth in order to achieve its results. These results are considered to be both improbable and disproven.
- The SSM review of the EMM Review found:
  - The EMM review is primarily focused on the groundwater and salinity impacts of the Estate.
  - DRC remains primarily concerned with the off-site, downstream impacts, i.e. the known salinity hot-spot of Troy Gully and Eastridge.
  - EMM conclude that waterlogging of soils will occur on the site at times, contrary to EnviroWests assertions.
  - EMM note that the predicted *"outcome is heavily reliant on the uptake of water by the proposed vegetation in roadside reserves."*
  - EMM made four recommendations;
    - *"Ensure that the selected vegetation can take up excess soil water as required"*. This seems unlikely given the design and plant selection offered in the Vegetation Management Plan (see below).
    - *"Apply appropriate water and landscape engineering to cope with intermittent waterlogging"*. This element is not referenced in the SMS review.
    - *"Stage the proposed development with sufficient time between stages to allow reconfiguration of subsequent blocks if problems are identified"*. No time period is suggested by EMM, SSM have suggested 10 years between stages, based on the SoilWater findings. Additionally based on the proposed stage 1 DRC would suggest that each stage comprise no more than 10% of the proposed lot yield.
    - *"Monitor groundwater levels on and within 1km of the site and use resulting water level to guide mitigation measures"*. This

recommendation is vague and does not place responsibility for the action on any person or organisation. DRC believe this should be the responsibility of the proponent.

- The SSM review of Daisy Hill Groundwater and Salinity Modelling found;
    - EnviroWest propose the concept that vegetation planted along the subdivisions roads will intercept groundwater, both at depths greater than 6m and uniformly. SSM cite research by Stirzaker which disproves both concepts. Tree zones will be able to intercept groundwater only shallower than 6m, and the zones between plantings (i.e. the residential lots) will experience significantly shallower groundwater than that once this state has been achieved as shown by the following diagram (taken from the SSM review).

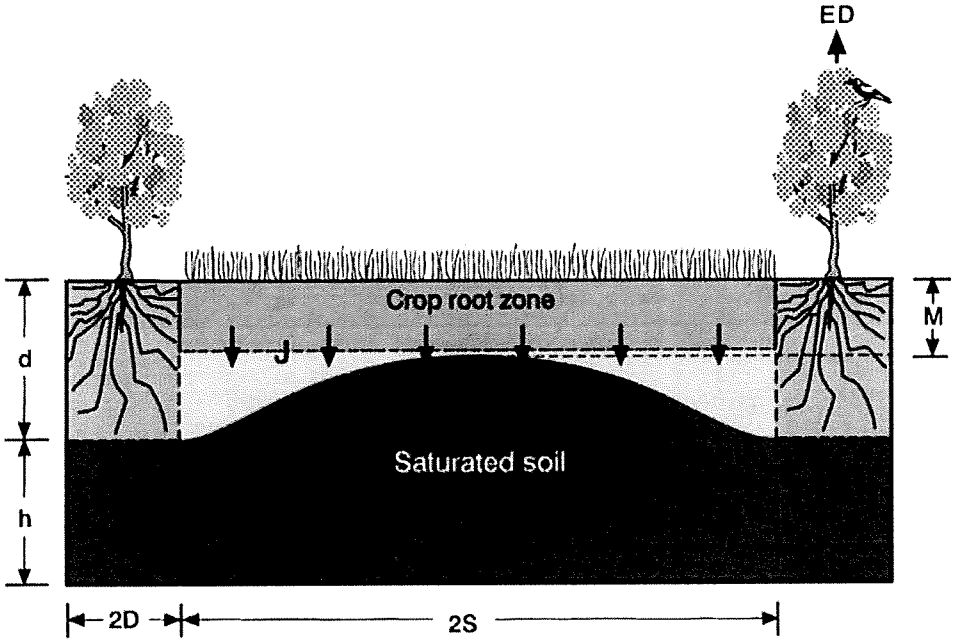

Figure 3. Schematic diagram showing the shape of the saturated zone between lines of trees on flat land when water table is above bottom of tree rootzone (from Stirzaker *et al.*, 2003). Symbols are; **S** is maximum half space to keep water table at desired level, **D** is half width of tree belt, **E** is annual use of water from water table, **M** is water table depth at mid point, **d** is depth to water table below trees, **h** is height of water table above impermeable layer, **J** is deep drainage below crop rootzone.

    - EnviroWest propose that tree plantings alone will lower the water table sufficiently to minimise shallow groundwater within the estate. Vegetation planting along roadways will likely lower groundwater along the planted corridors (roadways) but, as shown above will not decrease groundwater levels at distance (i.e. on the residential lots). Furthermore in order for groundwater to reach levels at which tree plantings will impact the groundwater level that groundwater must rise to <6m. In order to achieve

this, significant lateral pressure will be driving groundwater off site towards the vulnerable existing developments of Troy Gully and Eastridge.
    - EnviroWest have used an appropriate vertical modelling but appear not to have modelled horizontal groundwater flow.
    - The proposed subdivision will increase accession to the deep groundwater (i.e. >6m) thereby increasing lateral groundwater movement off site, i.e. towards Troy Gully.
    - Groundwater levels are currently shallow enough in 1 of 6 sites monitored that capillary rise would be expected to bring salt to the surface. DRC propose that this specific area not be developed and a substantial tree planting occur.
- The SSM comments in regard the Salinity Management Strategy;
    - The Salinity Management Strategy (SMS) focuses on shallow groundwater on the Daisy Hill estate site only. It does not address deep drainage which EnviroWests modelling identifies. This deep drainage is likely to move off site (i.e. to Troy Gully and Eastridge)
    - DRC is of the view that the SMS is not a single overarching document, it is dependent upon other documents and this, combined with its inability to address deep groundwater movement reduce the effectiveness and reliability of the Strategy. This in turn reinforces the need for long term groundwater monitoring in the order of at least 10 years, both on and off site, between stages and for restriction on stage sizing's to be no greater than 10% of proposed lot yield.
- The SSM comments in relation to the vegetation management Plan;
    - The species list proposed does not reflect the need for growth in shallow saline areas and is not appropriate.
    - There is no proposed variation in root architecture as was proposed in the SoilWater 2018 review.
    - The VMP contradicts earlier reports by stating the road reserves will not experience water logging
    - DRC is of the view that the plantings may serve to reduce groundwater, salinity and water logging on selected locations within the proposed estate but will not impact groundwater deeper than 6m (which will likely move off site downslope), nor will they serve to intercept shallower lateral movements off site as the bulk of the plantings are to the east of the subdivision rather than downslope to the west.

2. Development Control Plan

It is noted that a draft Development Control Plan for the land was included in the documents that were placed on public display. This is the first viewing Council has had of this document. In reviewing the exhibited documents, it appears that there

was no further information addressing how the draft Development Control Plan was prepared, and whether the draft DCP is a Policy administered by the State Government Department of Planning or if it is to be administered by Dubbo Regional Council.

Notwithstanding how the Joint Regional Planning Panel will consider the future management of the site specific Development Control Plan, Council requests further time in which to undertake a detailed review and to determine if the measures included in the draft Development Control Plan are appropriate to manage any development on the land and the impacts of that development.

It should also be noted that if the draft Development Control Plan is to form a Council Policy, this document should be reviewed by Council and to form a separate public engagement and review process, prior to the consideration of any submissions by Council.

(Attachment; Sustainable Soils management, "Review of Daisy Hill Groundwater and Salinity Study and Salinity Management Strategy", 2019)

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Review of Daisy Hill Groundwater and Salinity Study and Salinity Management Strategy

Prepared for: **Dubbo Regional Council**

August 2019

Prepared by: **Dr Pat Hulme**

SUMMARY

The groundwater and salinity study and salinity management strategy for the proposed Daisy Hill Estate relies on at least 7 reports that contain an updated study, modifications to the study, reviews of the study, and management plans.

The salinity management strategy and vegetation management plans divide the proposed development into 2 groundwater flow regimes.

Approximately 25% of the proposed development has a slightly to moderately saline soil profile, groundwater levels of 1.4 and 5.6 m and highly saline groundwater. It appears that the salinity management strategy and vegetation management plans focus on managing the intermittent shallow groundwater and waterlogging that one of the peer reviewers recognized. This will be done by planting a large proportion of these areas to perennial vegetation of trees and shrubs to intercept local shallow groundwater.

The remaining 75% of the area has soil with generally low salinity and groundwater deeper than 12 m. The groundwater model used to support the salinity management strategy assumes that water will move laterally through this material without causing recharge to the underlying formation. However, it is likely that water will drain into the formation and contribute groundwater to lower land, such as Troy Gully, for the following reasons:

- Salinity profiles in this soil indicate that water drains past 6 m.
- Australian research has found that trees cannot lower groundwater levels deeper than 6 m below the surface, so the groundwater in these areas will need to rise more than 6 m into the tree rootzone in order for trees to extract water from other domains.
- Investigations have found that water levels between the tree belts must be shallower than under the tree belts in order to push water to the tree belts. So, the groundwater will need to rise more than 6 m between the tree belts for this lateral flow to occur.

One reviewer recommended that the proposed development be staged in order to judge the success of the salinity management strategy. The second reviewer modelled that it takes more than 16 years for groundwater to reach steady state at 6 m. Consequently, more than a decade between stages will be required to assess the effectiveness of the salinity management strategy.

Background

The proposed Daisy Hill Estate occupies Lot/Plan 200/DP825059, 661/DP565756, 661/DP565756, 64/DP754287, 65/DP754287, 316/DP754308 and 317/DP754308, and covers approximately 430 ha (Envirowest Consulting, 2017). Bourke Securities plans to change the landuse from grazing to 222 rural residential lots (Daisy Hill DCP Masterplan, downloaded from https://www.jrpp.nsw.gov.au/OnExhibition/tabid/112/ctl/view/JRPP_ID/2677/mid/534/language/en-AU/Default.aspx on 8/8/2019).

This report reviews the information presented in the Envirowest Consulting (2017a) groundwater and salinity study, supplementary information in the Envirowest Consulting (2017b) study, additional information in the Envirowest Consulting (2018a) report, reviews of this suite of reports, and a salinity management strategy and vegetation management plan that use the findings from the Envirowest Consulting reports and reviews of this work. These reports are listed in Table 1.

Table 1. Reports relevant to proposed Daisy Hill Estate salinity and ground water current at 8/8/2019.

Author, date, Report id	Report Title	Function
Envirowest Consulting, 10/8/2017. R13365s6	Updated groundwater and salinity study: Daisy Hill Estate: Proposed subdivision of Lot 200, DP825059, Lots 661 and 662 DP565756, Lots 64 and 65 DP754287, Lots 316 and 317 DP754308, Eulomogo Road, Dubbo NSW	Description of soil and groundwater patterns beneath proposed Daisy Hill Estate and an outline of salinity management strategies.
Envirowest Consulting, 12/12/2017. R13365s13	Hydraulic model simulations for Daisy Hill	Estimates of recharge beneath 3 typical profiles for 5 landuse types based on 1-Dimensional water flow model.
Soilwater Consultants, 16/4/2018. BSP-001-1-10	Daisy Hill groundwater and salinity study peer review	Review of groundwater and salinity study and hydraulic model simulations commissioned by Bourke Securities.
Envirowest Consulting, 18/4/2018. R13365s13	Additional groundwater information Daisy Hill	Expansion of 1- dimensional recharge estimates to 2 dimensional estimates assuming horizontal water flow.
EMM, 14/6/2018. J180043RP2	Independent review of Daisy Hill groundwater and salinity modelling	Review of groundwater and salinity study, hydraulic model simulations and additional groundwater information commissioned by NSW DPE.
Envirowest Consulting, 1/11/2018, L13365sms208	Salinity management strategy Daisy Hill residential estate.	Recommended actions to reduce risk of salinity to acceptable levels.
Soilwater Consultants, 1/4/2019. BSP-002-2-2	Vegetation plan (VMP) for the Daisy Hill subdivision	Species, layout and management for vegetation buffers.

The review was conducted against principles of the Australian Groundwater Modelling Guidelines (Barnett *et al.*, 2012).

DESCRIPTION OF DAISY HILL GROUNDWATER MODEL

The modelling approach adopted by Envirowest Consulting (2017b, 2018a) was to divide the proposed subdivision into 5 groundwater domains (Figure 1). Each groundwater domain was allocated a different water flow regime (Table 2), and it was assumed that groundwater could flow freely between the 5 domains along 2 paths. The first lateral flow path is the two surface soil layers in Figure 1. The second lateral flow path is that trees can extract any water that leaks past the rootzone of effluent irrigation, lawns and pasture.

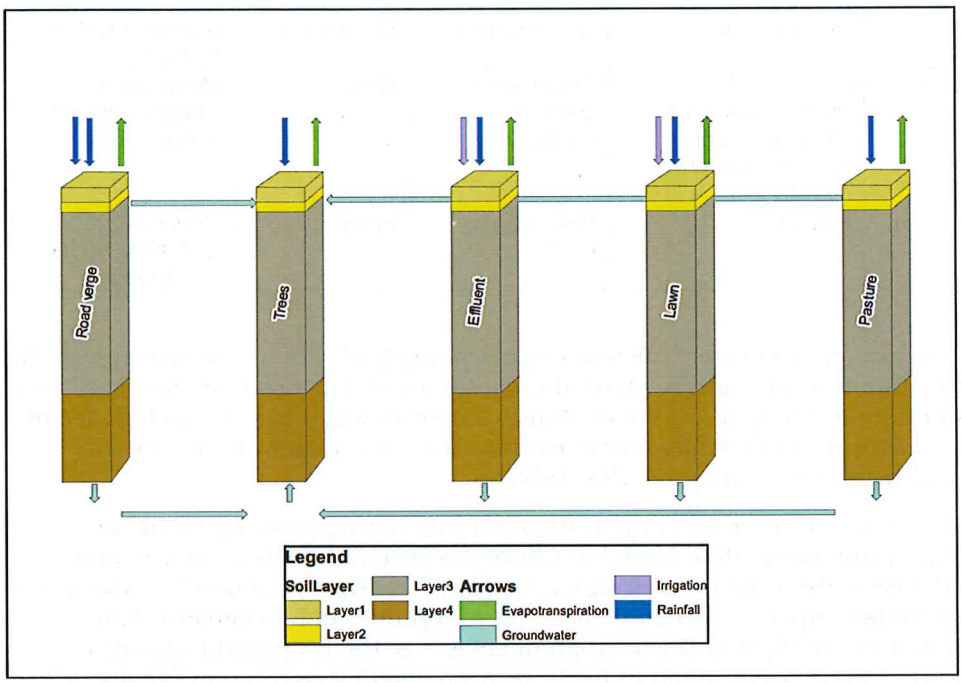


Figure 1. SSM interpretation of conceptual model used by Envirowest Consulting (2017b, 2018) for groundwater of proposed Daisy Hill Estate.

Table 2. Inflows and outflows for groundwater domains for proposed Daisy Hill Estate (from Tables 2 and 3, Envirowest Consulting, 2017b). Daily rainfall and evaporation were from Silo data drill for period from 1980 to 2014 (Envirowest Consulting, 2018a).

Domain	Surface water inflow	Transpiration	Groundwater inflow	Groundwater outflow
Road verge	Rainfall multiplied by 2	Crop Factor same as pasture	None	Modelled by CLASS U3M-1D direct to trees
Trees	Not modelled	Rainfall plus 0.5 mm/day	0.5 mm/day from all other domains	Assumed to be nil.
Effluent	Not modelled	Not modelled	Not modelled	0.5 mm/day direct to trees
Lawn	Rainfall plus 25 mm/week unless >20 mm rain or <20 mm evaporation (/week?)	Crop Factor same as pasture?	None	Modelled by CLASS U3M-1D direct to trees
Pasture	Rainfall	Pasture crop factor	None	Modelled by CLASS U3M-1D direct to trees

The gross groundwater inflows comprised solely of rainfall. Water applied by irrigation to lawns and to effluent disposal areas was assumed to come from runoff from 4.5 ha of buildings that is stored in water tanks. No balance of the water available and water used from these sources was calculated (Envirowest Consulting, 2018a, Table 3).

The source of water for effluent disposal was not reported by Envirowest Consulting, but Dubbo Regional Council reported that this water would be reticulated from the council water supply (L. Auld, pers comm.). This water source is supported by comments in the Vegetation Management Plan (Soilwater, 2019) that the location of stage 1 of the proposed Daisy Hill Estate will be constrained to being near an existing watermain (Figure 4.2, Soilwater, 2019). The inflow of the reticulated water into the proposed Daisy Hill Estate was not included in the Envirowest Consulting (2018a) water balance.

The area of each domain was reported in Table 6 by Envirowest Consulting (2018a). The total area of 380 ha in this on the pre-development Table 5 in Envirowest Consulting (2018a) was 50 ha less than the total area of the proposed estate of 430 ha reported by Envirowest Consulting (2017a).

The areas of each domain were estimated using the following procedures;

- Road verge area method was not reported.
- Area of trees was mapped in the Draft DCP Masterplan.
- Effluent disposal area of 0.05 ha/Lot (compared to 0.054 ha/Lot for Red Earth soil and 0.072 ha/Lot for Red Earth soil recommended by Envirowest Consulting, 2015).
- Lawn area of 0.13 ha/Lot (Envirowest Consulting, 2018a).

- Pasture area was calculated as the area of each lot that was neither lawn nor effluent disposal (calculated by difference between areas in Table 6, Envirowest Consulting (2018a) and Lot area in Master Plan (Heath Consulting, 2019).

The 5 groundwater domains were applied to 3, 6 m deep soil profile types. The soil hydraulic properties were default van Genuchten parameters in the CLASS U3M-1D model (Vaze *et al.*, 2004) for selected soil texture profiles that were logged by Envirowest Consulting (2017b).

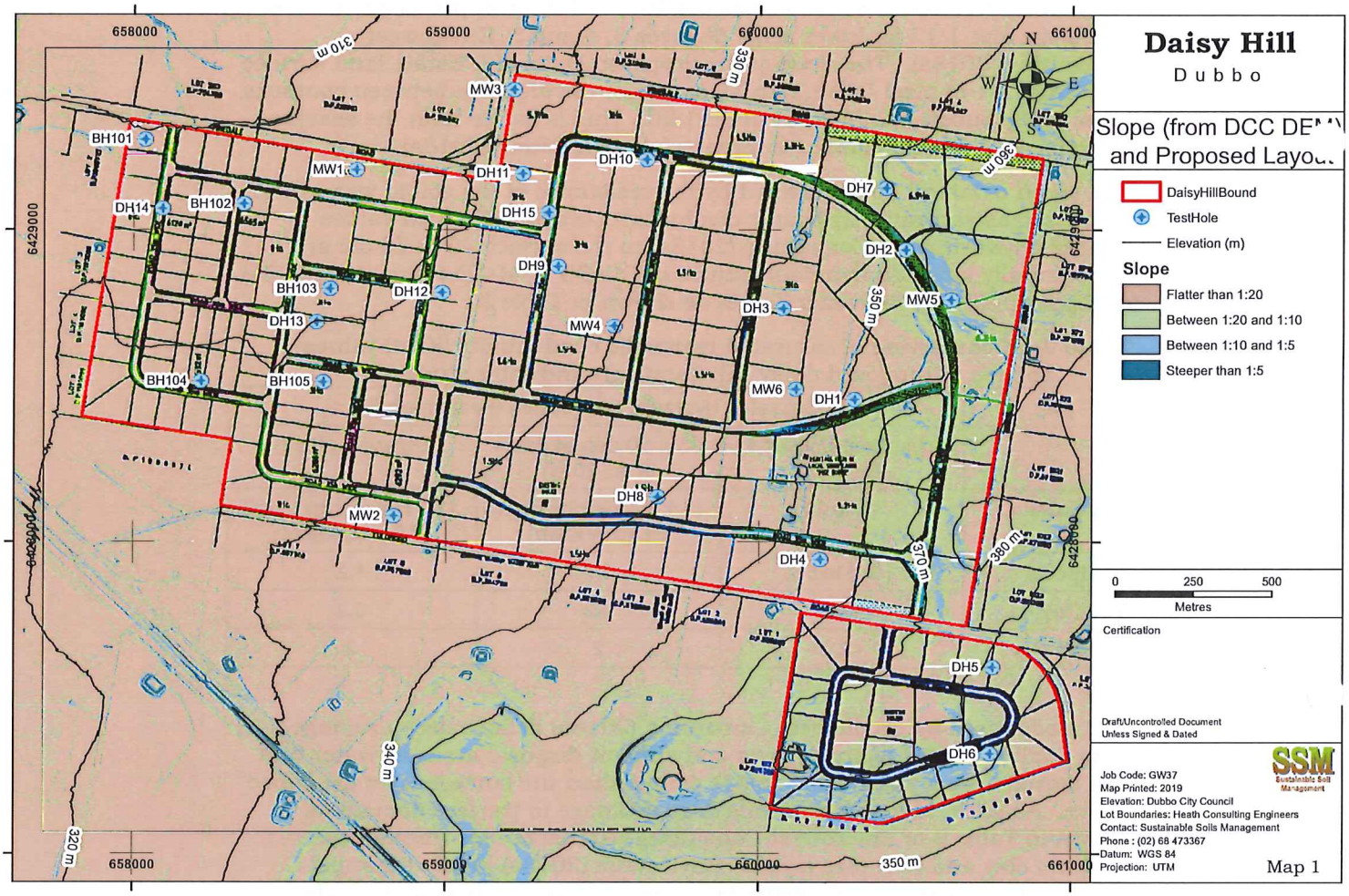
Lateral groundwater flow between domains is driven by fall across the land, and is assumed to occur with no head loss or regard to water content of the formation. The assumed fall across the land is 1:3 for upper slope, 1:12 for mid slope and 1:12 for lower slope (Figures 3, 4 and 5, Envirowest Consulting, 2018a). The slope of the proposed Daisy Hill Estate land surface both from a 1 m pixel DEM (Map 1), and from the distance between contours is generally substantially flatter than 1:20. This is flatter than the assumed slope for all 3 Lot schematics in Envirowest Consulting (2018a).

The speed of lateral flow is limited by the resistance of the soil to water flow, expressed as saturated hydraulic conductivity (Ksat). The Ksat values applied by Envirowest Consulting (2018a) to the surface 20 to 70 cm are substantially larger than default values in CLASS U3M-1D (Vaze *et al.*, 2004) or those applied by Soilwater (2018) as shown in Table 3.

Table 3. Comparison of saturated hydraulic conductivity (Ksat) values applied to proposed daisy Hill Estate groundwater study.

Soil Type	Saturated Hydraulic Conductivity (Ksat, mm/hr)		
	Envirowest Consulting (2018a)	U3M-1D default (Vaze *et* al., 2004)	Soilwater (2018)
Clay Loam	10 to 20	13.1 (sandy clay loam) 2.6 (clay loam)	13.1 (sandy clay loam) 2.6 (clay loam)
Sandy clay	2.5 to 5	1.2	1.2
Silty Clay	<2.5	0.2	0.2
Medium clay	<2.5	2	2

The model used by Envirowest Consulting (2018a) defines deep drainage from shallow rooted pasture, lawn and effluent disposal areas as water that has moved deeper than 1 m. This is deeper than the surface layer described above. As such, lateral flow of this deep drainage to the tree domain as shown in Table 6 of Envirowest Consulting (2018a) occurs through the medium clay and silty clay layers. Envirowest (2018a) justify the rapid lateral water movement in deeper layers in *"thin gravel and sand bands common in the profile"*. These sand and gravel layers are explicitly noted in 6 of 28 logs in Appendix V of Envirowest Consulting (2017a).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Between 1:20 and 1:10
Between 1:10 and 1:5
Steeper than 1:5
0
250
500
Metres
Certification
Draft/Uncontrolled Document
Unless Signed & Dated
SSM
Sustainable Soil Management
Job Code: GW37
Map Printed: 2019
Elevation: Dubbo City Council
Lot Boundaries: Heath Consulting Engineers
Contact: Sustainable Soils Management
Phone : (02) 68 473367
Datum: WGS 84
Projection: UTM
Map 1

Groundwater levels in the proposed Daisy Hill Estate were recorded in 8 piezometers constructed as 2 nests of 2 piezometers and 4 single piezometers. As such, this network measures groundwater levels at 6 sites. Groundwater levels were measured at the time of drilling and a few weeks later. At that time, the groundwater level was deeper than 12 m below the soil surface at 4 sites, 5.6 m at one site, and 1.4 m at the remaining site. The groundwater sampled at 3 of the 4 sites was highly saline (15 to 21 dS/m), while the remaining piezometer had saline groundwater (5 dS/m). This mix of groundwater salinity is substantially higher than recorded in the 12 piezometers closest to the proposed Daisy Hill Estate in which 42% of sites had salinity less than 3 dS/m (Envirowest Consulting, 2017a).

A water balance generated by Envirowest Consulting (2018a) indicate that annual average recharge under pasture beneath 380 ha of the proposed Daisy Hill Estate is 5.1 mm or 5,111 m^3. The Total Recharge of 5,111 m^3 differs from the sum of recharge from the separate domains of 19,087 m^3.

A similar water balance indicates that the post-development annual recharge from the proposed Daisy Hill Estate will be -4.9 mm or -16,632 m^3. This implies that there will be groundwater inflow from outside the proposed Daisy Hill Estate to satisfy the demand. Envirowest Consulting (2018a) do not indicate the source of the water to satisfy this calculated shortfall.

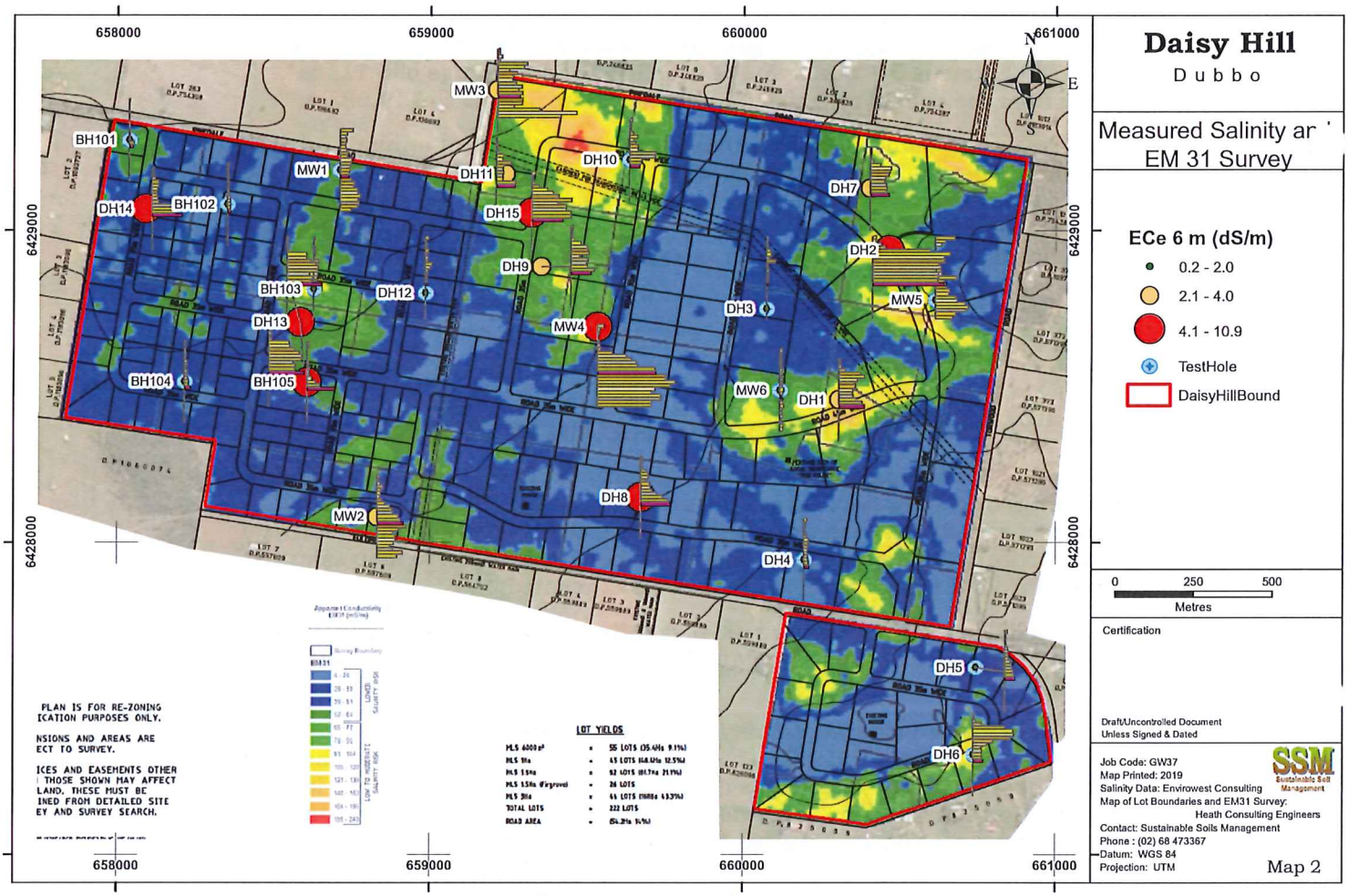
DESCRIPTION OF DAISY HILL SALINITY MODEL

Envirowest Consulting (2017a) measured soil salinity in 26 test holes drilled to between 6 to 16 m deep across the proposed Daisy Hill Estate. The pattern of salinity between these sites was correlated with apparent electrical conductivity (ECa) from an EM31 survey. The method used to map salinity patterns from the measured points is not documented.

The area of land with moderate risk of salinity was mapped as approximately 3% of the proposed Daisy Hill Estate (Figure 11, Envirowest Consulting, 2017a).

The area of low to moderate salinity risk in the Master Plan (Heath Consulting Engineers, 2019) has increased to approximately 25% of the total area. These areas are depicted as the green, yellow and orange areas in Map 2. Some of these areas are described as the contact zone between the Pilliga Sandstone and Purlewaugh Formation geology in the Salinity Management Strategy (Envirowest Consulting, 2018b) and Vegetation Management Plan (Soilwater, 2019), but not mapped in the suite of reports.

There is no salt balance in the 3 Envirowest Consulting reports that describe the salinity and groundwater investigations on the proposed Daisy Hill Estate (Envirowest Consulting, 2017a, 2017b and 2018a).



Daisy Hill

Dubbo

Measured Salinity ar ' EM 31 Survey

ECe 6 m (dS/m)

- 0.2 - 2.0
- 2.1 - 4.0
- 4.1 - 10.9
- TestHole
- DaisyHillBound

0 250 500

Metres

Certification

Draft/Uncontrolled Document
Unless Signed & Dated

Job Code: GW37
Map Printed: 2019
Salinity Data: Enviroswest Consulting
Map of Lot Boundaries and EM31 Survey:
Heath Consulting Engineers
Contact: Sustainable Soils Management
Phone : (02) 68 473367
Datum: WGS 84
Projection: UTM

SSM Sustainable Soil Management

Map 2

COMMENTS ON THE SOILWATER REVIEW OF PROPOSED DAISY HILL ESTATE SALINITY AND GROUNDWATER INVESTIGATION.

Soilwater (2018) focussed on the vertical component of the Envirowest Consulting (2017b, 2018a) groundwater model. They did this by assessing the accuracy of deep drainage estimates from the 3 typical profiles used by Envirowest Consulting. Soilwater compared deep drainage estimates generated by Hydrus 1-D (Simunek *et al.,* 2008) with those generated by CLASS U3M-1D (Vaze *et al.,* 2004). Soilwater (2018) found that these 2 similar models predicted similar deep drainage rates when run with similar inputs.

Soilwater (2018) accept the Envirowest Consulting (2017b, 2018a) assumption that water will move laterally through subsurface layers of the proposed Daisy Hill Estate with little loss in head.

Soilwater (2018) interpret the tree water regime adopted by Envirowest Consulting (2017b, 2018a) as total transpiration of 0.5 mm/day. This interpretation would require no rainfall on the area where trees are planted, and free groundwater movement from other domains to the tree rootzone.

Profile graphs in Figures 1 to 11 of Soilwater (2018) indicate that the starting profile moisture contents of Hydrus simulations range from around 0.11 to 0.17 m^3/m^3. In contrast, the ending moisture contents of 5 of 6 layers are of the order of 0.3 m^3/m^3 or greater. This initial moisture content is not consistent with the current Daisy Hill Estate groundwater system that is producing discharge as tabulated in Envirowest Consulting (2017b, 2018a). As a result, it is inconsistent with Barnett *et al.*, (2012) who recommend that initial conditions should reflect steady state conditions at the start of the model run. Although this inconsistency will affect the magnitude of estimated deep drainage rate, it is unlikely to change the general conclusion that deep drainage will be of the order of a few mm/year.

COMMENTS ON THE EMM REVIEW OF PROPOSED DAISY HILL ESTATE SALINITY AND GROUNDWATER INVESTIGATION.

The review by EMM (2018) focuses primarily on the effect of modelled groundwater regime on groundwater levels within the proposed Daisy Hill Estate. This is based on EMM (2018) accepting the Envirowest Consulting (2018a) conclusion that *"the development will not result in a net increase in groundwater recharge to the water table".*

The EMM (2018) review concludes that *"it would seem likely that waterlogging of shallow soils will occur at times".* The EMM (2018) review also notes that the predicted *"outcome is heavily reliant on uptake of water by proposed vegetation in roadside reserves".*

EMM (2018) makes 4 recommendations based on their interpretation of the Envirowest Consulting (2017a, 2017b and 2018a) and Soilwater (2018) reports. These can be paraphrased:

1. Ensure that selected vegetation can take up excess soil water as required.
2. Apply appropriate water and landscape engineering to cope with intermittent waterlogging.
3. Stage the proposed development with sufficient time between stages to allow reconfiguration of subsequent block if problems are identified.
4. Monitor groundwater levels on and within 1 km of the site and use resulting water levels to guide mitigation measures.

EMM (2018) do not comment on the time lag between stages, but the Soilwater (2018) estimate that it took more than 14 years for wetting front to reach 6 m implies that it would be appropriate to wait a decade or more between stages.

SSM REVIEW OF DAISY HILL GROUNDWATER AND SALINITY MODELLING.

Groundwater

The Soilwater (2018) and EMM (2018) reviews indicate that the conceptual model of a number of soil domains represented by 1-dimensional water flow models and linked by lateral flow (Figure 1) is an appropriate way to characterise groundwater in the proposed Daisy Hill Estate. We agree that this conceptual model is an appropriate one, but not the way it has been applied.

This is because we have reservations about the magnitude of the lateral flow between these domains. These reservations will be outlined separately for the shallow (<70 cm) and deep (>1 m) layers.

For the shallow soil layer, Envirowest Consulting (2017a, 2017b, 2018a) relies on the guidelines of Rassam and Littleboy (2003) to justify the contribution of lateral flow in the surface 70 cm to groundwater flow from the domains towards the trees. Rassam and Littleboy (2003) developed an empirical equation that estimates lateral groundwater hydraulic conductivity as a proportion of vertical hydraulic conductivity. Inputs to the Rassam and Littleboy (2003) equation are the surface slope in degrees, and the ratio between soil saturated hydraulic conductivity above and below an interface. For the range of surface slope across the proposed Daisy Hill Estate (Map 1) the ratio is of the order of 11%. As a result, data from Table 3 indicates that lateral flow rates would be expected to be of the order of 0.2 to 2 mm/hr for the clay loam layers in Figures 3 to 5, Envirowest Consulting (2018a). Similarly, lateral flow rates in sandy clay would be expected to be of the order of 0.1 to 0.5 mm/hr. These values indicate that the surface 20 to 50 cm of clay loam soil in Figures 3 to 5, Envirowest Consulting (2018a) has the capacity to transmit a measurable quantity of water laterally, but the underlying sandy clay does not.

The calculations below indicate the magnitude of this flow. This is done by calculating the volume of water transferred by lateral flow from a 1 m wide strip of the soil depicted in Figure 4 (Envirowest, 2018a) based on the following assumptions:

- The lot is rectangular, with the length being twice the width or 172 m.
- The cross-sectional area transmitting water is 0.5 m deep by 1 m wide.
- Discharge rate is 2 mm/hr.

From these data, the volume discharged into the vegetated area is:

- 1 m wide by 0.5 m deep by 2 mm/hr = 0.001 m^3/hr or 1 L/hr.

For the area of 172 m by 1 m being drained, the volume being drained is equivalent to an average depth of:

- Volume of 0.001 m^3/hr divided by area of 172 m^2 = 6 µm/hour.

This indicates that it would take almost 1 week to drain 1 mm of water from the 1.5 ha lot in Figure 4, Envirowest Consulting (2018a) to the vegetation strip. Output from the CLASS3 UM-1D model for pasture in the profile of Figure 4, Envirowest Consulting (2018a) indicates that this layer would be expected to be saturated for less than 3% of days, so the lateral flow may account for around 1.5 mm/year in the soil with the thickest clay loam layer on the proposed Daisy Hill Estate.

For soil deeper than the pasture rootzone, Envirowest Consulting (2017a, 2017b and 2018a) propose that water will flow along gravel and sand lenses intercepted in some test holes. This mode has been evaluated by Stirzaker *et al.,* (2003) who examined 2 scenarios relevant to the proposed Daisy Hill Estate. The first scenario is when the water table is below the depth of tree root system. In this case, Stirzaker *et al.*, (2003) found that trees access little water by lateral flow because the capture zone (Figure 2) is dry, consequently transmits little water.

a) between rainfall events

b) soon after prolonged rainfall

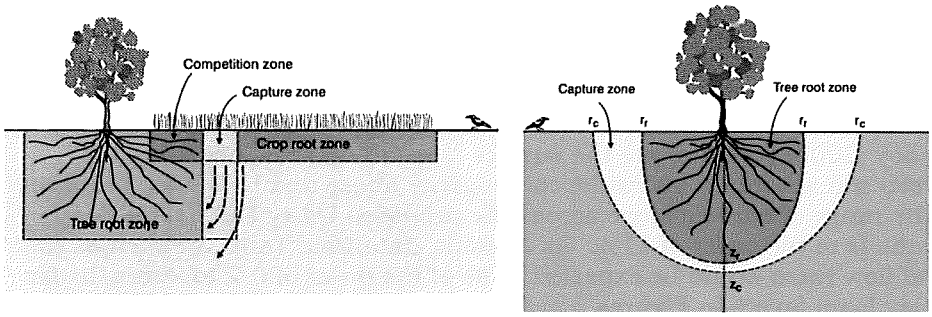


Figure 2. Schematic diagram of water uptake by trees when groundwater level is below tree rootzone (from Stirzaker *et al.*, 2003).

The second case is where the water table is above the tree rootzone and trees can lower the water table by extracting water from greater depth than the crops or shallow rooted pasture (Figure 3). Stirzaker *et al.*, (2003) predict that the water table between the tree lines will be substantially shallower than the water level near the tree rootzone (Figure 3) and propose that this difference in water height provides the force to move water towards the tree rootzone. Stirzaker *et al.*, (2003) provide mathematical estimates of the maximum half distance (S in Figure 3) as a function of deep drainage rate, soil saturated hydraulic conductivity and tree rootzone depth.

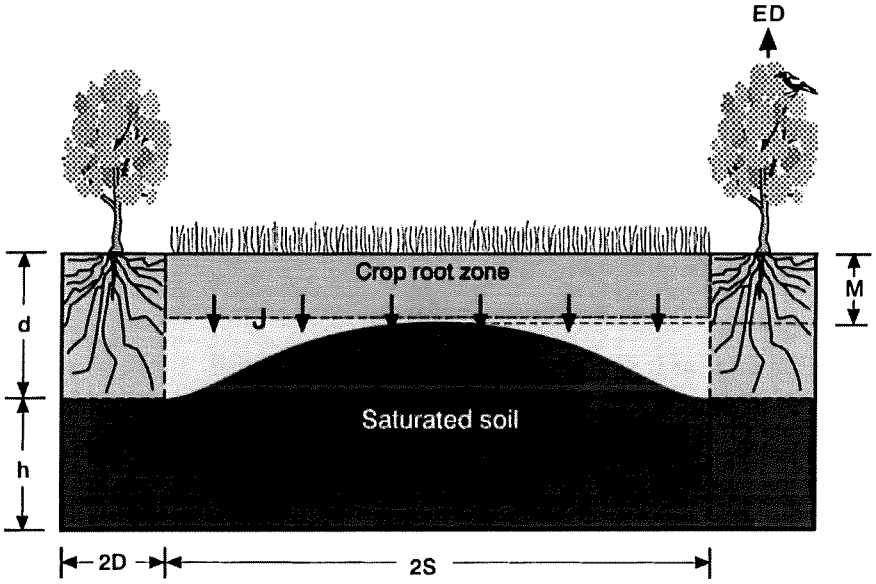


Figure 3. Schematic diagram showing the shape of the saturated zone between lines of trees on flat land when water table is above bottom of tree rootzone (from Stirzaker *et al.*, 2003). Symbols are; **S** is maximum half space to keep water table at desired level, **D** is half width of tree belt, **E** is annual use of water from water table, **M** is water table depth at mid point, **d** is depth to water table below trees, **h** is height of water table above impermeable layer, **J** is deep drainage below crop rootzone.

These estimates indicate that the proposed tree plantings could lower the water table sufficiently to minimise the area of shallow groundwater within the proposed Daisy Hill Estate. However, there will be some deep drainage beneath the land as a shallow water table is required to provide the force to move water towards the trees. Furthermore Benyon *et al.,* (2006) in a review of data from 21 Australian sites found that trees could lower groundwater levels to around 6 m. As a result, trees will not take up significant groundwater in areas represented by Figures 3 to 5 and Envirowest Consulting (2018a) until groundwater levels rise from the current 12 and 14 m to shallower than 6 m.

CONCLUSIONS

- The conceptual groundwater flow model of Envirowest Consulting (2017a, 2017b and 2018a) contains vertical and horizontal components. It appears that they have used appropriate models for the vertical component, but they have not quantified the horizontal component, despite relying on this to claim that the proposed development will extract 16,632 m^3 of groundwater annually.
- Estimates by SSM indicate that the surface 0.7 m of soil in the proposed Daisy Hill Estate has the capacity to drain 1 mm/week to the vegetation zones from the 1.5 ha Lots. This flow only occurs while the soil is saturated, which was estimated to be around 3% of days.
- Australian research indicates that trees are unlikely to take up significant volumes of groundwater until the water table is shallower than 6 m. This will require a substantial rise in groundwater levels over parts of the proposed Daisy Hill Estate. In addition, groundwater levels between the trees will need to be shallower than 6 m to push water towards the tree roots. Recharge of underlying layers will also occur at the same time as this lateral flow. This recharge may threaten downslope areas such as Troy Gully.
- As a result, it is unlikely that the proposed layout of strips of trees around the edge of lots will reduce deep drainage from the proposed Daisy Hill Estate to zero.
- Data collected and interpreted by Envirowest Consulting (2017a) indicates that the proposed vegetation could keep water table deeper than the pasture rootzone.

Salinity

Salinity is addressed by measurements of soil and groundwater salinity in Envirowest Consulting (2017a), but given little attention in the groundwater simulations (Envirowest Consulting 2017b, 2018a) or reviews of groundwater and salinity modelling by Soilwater (2017) or EMM (2018). Perhaps this is because Figure 11 of Envirowest Consulting (2017a) indicates there is little salinity hazard in 97% if the area of the proposed Daisy Hill Estate. In contrast, elevated salinity near the contact zone between the Pilliga Sandstone and Purlewaugh Formation was used when planning the Salinity Management Strategy (Envirowest Consulting (2018b) and preparing the Vegetation Management Plan (Soilwater, 2019)

We reassessed the extent of salinity hazard across the proposed Daisy Hill Estate by estimating the EM31 apparent electrical conductivity (ECa) above which soil electrical conductivity of saturated extract (ECe) would be expected to be greater than 2 and 4 dS/m for 15 soil layers from the surface to 6 m. Soil salinity (ECe) in this scatter plot was generated from soil data in Appendix 5 of Envirowest Consulting (2017a) and ECa was estimated from the EM31 ECa surface in Map 2. The critical values were selected to represent slightly saline (ECe of 2 to 4 dS/m, Hazelton and Murphy, 2007) and moderately saline (4 to 8 dS/m) soil.

The resulting scatter plot indicated that salinity was uncommon in the 0 to 10, 10 to 20 and 20 to 30 cm layers (Figure 4). Slightly saline soil in the 40 to 50 cm layer was expected in areas where EM 31 ECa was greater than 170 mS/m. In contrast, soil salinity was expected to be greater than 4 dS/m for all 11 layers deeper than 50 cm where EM 31 ECa was greater than about 105 mS/m. There was a trend that the critical EM 31 ECa for ECe of 2 dS/m decreased from 90 mS/m in the 50 to 100 cm layer to less than 50 mS/m for the 550 to 600 cm layer.

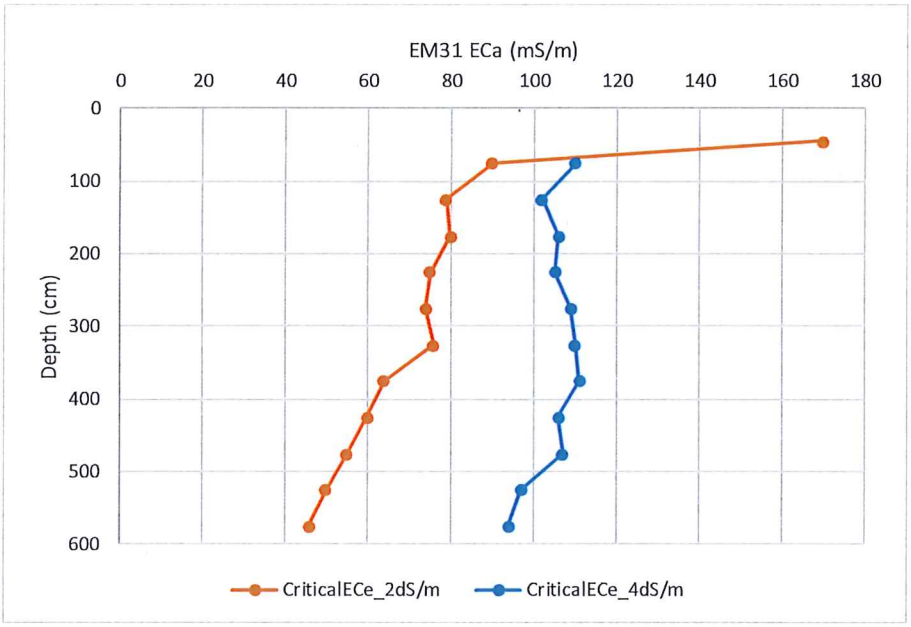


Figure 4. Critical EM31 apparent electrical conductivity (ECa) above which soil salinity measured as electrical conductivity of saturated extract (ECe) was greater than 2 and 4 dS/m across proposed Daisy Hill Estate.

This indicates that salinity would be expected to be low enough to not restrict root growth to 6 m where EM31 ECa is less than about 50 mS/m (blue areas in Map 2). Similarly, salinity would be expected to restrict root growth of salt sensitive plants in the 50 to 550 cm layers of areas with EM 31 ECa greater than 100 mS/m (yellow, orange and red areas in Map 2).

The salinity profiles indicate that salinity should not restrict growth of shallow rooted plants provided groundwater is moving downwards. Groundwater monitoring indicated that water levels were shallow enough to

cause capillary rise in MW3, but not the remaining 5 sites monitored (Envirowest Consulting, 2017a).

The salinity measurements indicate that trees grown in the 25% of the proposed Daisy Hill Estate will require some degree salt tolerance if they are to function effectively in lowering groundwater levels.

The salinity profiles of DH3, DH4, DH5, DH12, BH101, BH102, BH104, MW1 and MW6 have low ECe from the surface to 6 m (Map 2), indicating that there has been recharge beyond this depth (Figure 5). It is likely that this deep drainage will continue if groundwater levels in these areas rise to shallower than 6 m as would be required to push groundwater towards trees as shown in Figure 3.

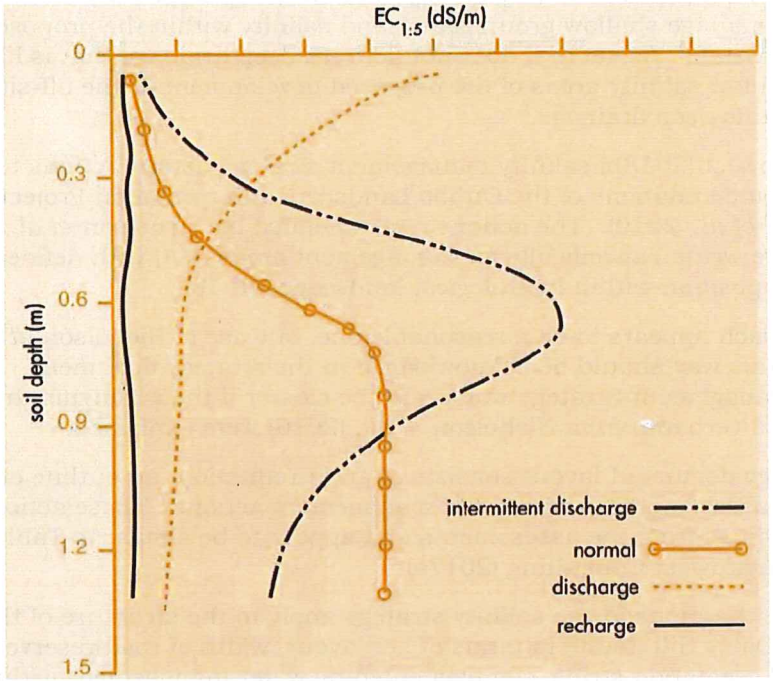


Figure 5. Typical soil salinity profile shapes for 4 different drainage patterns (from DNR, 1997).

CONCLUSIONS

- 26 soil salinity profiles from the proposed Daisy Hill Estate indicated that there is little salinity in the surface 50 cm of soil at the sites sampled.
- Correlation between the EM 31 survey and the measured salinity profiles indicated that salinity will restrict the potential root growth of salt sensitive trees in around 25% of the proposed Daisy Hill Estate.
- These patterns indicate that there is little threat of secondary salinity unless groundwater is moving upward.
- The shape of soil salinity profiles at one third of sites sampled indicates that they are recharge sites. This is likely to continue if

groundwater levels rise, as is required to push water towards the vegetation zones.

- Groundwater levels are shallow enough in 1 of 6 sites monitored that capillary rise would be expected to bring some salt to the surface.
- The groundwater and salinity study does not include a salt balance or salinity model.

COMMENTS ON SALINITY MANAGEMENT STRATEGY

The Envirowest (2018b) salinity management strategy appears to have been written to manage shallow groundwater and salinity within the proposed Daisy Hill Estate. As such, it does not address deep drainage that is likely to occur from low salinity areas of the proposed development or the off-site impact of this deep drainage.

The Envirowest (2018b) salinity management strategy details actions to follow recommendations of the Dubbo Landscape Interpretation Project (Nicholson *et al.,* 2010). The actions recommended by Nicholson *et al.,* (2010) were written specifically for management areas (MA) with defined landscape position within hydrological landscapes (HGL).

This approach appears to be a reasonable one, but use of Nicholson *et al.,* (2010) in this way should be acknowledged in the strategy document. The Salinity Management Strategy would also be clearer if the acronyms that were copied verbatim from Nicholson *et al.,* (2010) were explained.

The strategy document layout consists of an introduction, an outline of (previous) assessments, and a list of management actions. These actions rely on findings from the assessments and appear to be similar to Tables 14 to 18 in Envirowest Consulting (2017a).

Management Actions in the salinity strategy apply to the structure of the proposed Daisy Hill Estate in terms of Lot layout, width of road reserves, location of vegetation strips, complemented by water management within individual Lots. This is a sound approach to salinity management within the proposed Daisy Hill Estate.

However, an assessment of the likely effectiveness of the approach relies on accurate communication of how well the proposed management actions are related to the landscape properties. Given this relationship, it seems important that the location of the contact zone between Pilliga Sandstone and Purlewaugh Formation be clearly marked. Piezometers installed in Pilliga Sandstone in this contact zone should be identified.

Similarly, it would be useful to include in the salinity management strategy a map showing the locations of all areas planned to be planted to perennial vegetation overlaid on the areas with saline subsoil and shallow groundwater.

The EM31 survey in Map 2 of this report shows patches of moderately saline soil along the southern edge of the proposed Daisy Hill Estate. Measured salinity between 50 and 250 cm in test hole DH6 averaged 5.7 dS/m (Envirowest Consulting, 2017a) which is in the moderately saline range of

Hazelton and Murphy (2007). This area warrants additional actions to avoid salinity.

A further point in relation to clarity is that the boundaries between Management Areas 1 and 2 in both the Richmond Estate and Firgrove hydrological units are not shown in Attachment 1. This boundary is relevant because different actions are recommended for these management areas, and confusion can occur if there is uncertainty about the actions that apply to individual Lots.

In summary, it is likely that actions recommended in the salinity management strategy will reduce salinity within the proposed Daisy Hill Estate compared to development without these actions. However, it is also likely that there will be groundwater flow from the proposed Daisy Hill Estate into downslope areas such as Troy Gully.

The appropriateness of actions in the Salinity Management Strategy cannot be determined from viewing this document alone. A clear depiction of the zone of contact between the Pilliga Sandstone and Purlewaugh Formation is an important omission from the suite of documents that support the salinity management strategy.

It also appears that the EM survey has identified some areas of elevated salinity near the south eastern corner of the proposed Daisy Hill Estate. The areas in the Richmond Estate hydrological landscape have been addressed by increasing lot size, but the areas in the Firgrove hydrological landscape have not.

The Salinity Management Strategy does not mention staging of the proposed Daisy Hill Estate that was recommended by EMM (2018), nor does it mention the groundwater monitoring that EMM (2018) recommend. This should be remedied.

COMMENTS ON VEGETATION MANAGEMENT PLAN

Perennial vegetation in the proposed Daisy Hill Estate will play an important role in taking up excess moisture from other land use types (EMM, 2018). As such, this vegetation will play a crucial role in the success of the Envirowest Consulting (2018b) salinity management strategy in addressing shallow groundwater and salinity within the proposed Daisy Hill Estate.

The Vegetation Management Plan for the Daisy Hill Subdivision (Soilwater, 2019) contains:

- Conceptual cross sections of the vegetated corridors,
- The areas to be planted to perennial vegetation,
- The location of these areas in relation to apparent electrical conductivity (ECa) from the EM31 survey,
- A list of species,
- Guidelines for plant arrangement and density and for establishment,
- Comments on staging.

This report layout is logical and the information used is consistent from one section to the next. However, there appear to be some shortcomings.

The EM31 survey indicates that there is a range in existing soil salinity across the proposed Daisy Hill Estate. The vegetation plan could be improved if the list of suitable trees reflected suitability of the trees to grow in soil with low salinity, and soil that is slightly saline to moderately saline. It is also logical that trees and shrubs with greater tolerance to salinity are planted in the areas of the contact zone between the Pilliga Sandstone and Purlewaugh Formation. It would be helpful if Envirowest Consulting (2017a, 2017b, 2018a and 2018b) mapped this zone in their suite of reports.

The second is that there is some conflict between the predicted surface soil water regime between the groundwater peer review of Soilwater (2018) and the Vegetation Management Plan of Soilwater (2019). Soilwater (2018) recommends that the proposed vegetation contain "*a species mix of both shallow and deep rooting species with good drought and waterlogging tolerance*". Soilwater (2019) does not mention root architecture and states that vegetation in road reserves "will not experience waterlogging". Perhaps the species selection could be fine-tuned to take these differences into account.

REFERENCES

Barnett, B., Townley, L.R., Post, V., Evans, R.E., Hunt, R.J., Peeters, L., Richardson, S., Werner, A.D., Knapton, A., and Boronkay, A., 2012. Australian groundwater modelling guidelines. Waterlines report, National Water Commission, Canberra. 204 pp.

Beynon, R.G., Theiveyanthan, S., and Doody, T.M., 2006. Impacts of tree plantations on groundwater in south-eastern Australia. Australian Journal of Botany. 54:181-192.

Department of Natural Resources, 1997. Salinity Management Handbook. Scientific Publishing, Resource Sciences Centre. 214 pp.

EMM. 2018. Independent review of Daisy Hill groundwater and salinity modelling. Report JI180043RP2 prepared for Department of Planning and Environment.

Envirowest Consulting, 2015. On-site effluent management study: Daisy Hill Estate: Proposed subdivision of Lot 200, DP825059, Lots 661 and 662 DP565756, Lots 64 and 65 DP754287, Lots 316 and 317 DP754308, Eulomogo Road, Dubbo NSW. Report Number R13365e.1 prepared for Bourke Securities, Dubbo. 14 pp +Figs, App.

Envirowest Consulting, 2017a. Updated groundwater and salinity study: Daisy Hill Estate: Proposed subdivision of Lot 200, DP825059, Lots 661 and 662 DP565756, Lots 64 and 65 DP754287, Lots 316 and 317 DP754308, Eulomogo Road, Dubbo NSW. Report Number R13365s6 prepared for Bourke Securities, Dubbo. 44 pp +Figs, App.

Envirowest Consulting, 2017b. Hydraulic model simulations for Daisy Hill. Report Number L13365s13 prepared for Bourke Securities, Dubbo. 6 pp.

Envirowest Consulting, 2018a. Additional groundwater information. Report Number L13365s14 prepared for Bourke Securities, Dubbo. 8 pp +Figs.

Envirowest Consulting, 2018b. Salinity management strategy Daisy Hill Residential Estate. Report Number L13365sms208 prepared for Bourke Securities, Dubbo. 12 pp +Attachments.

Hazelton, P.A., and Murphy, B.W., 2007. Interpreting soil test results: What do all the numbers mean? CSIRO, Melbourne. 152 pp.

Heath Consulting. 2019. Final DCP Masterplan of proposed Daisy Hill Estate. Downloaded from https://www.jrpp.nsw.gov.au/OnExhibition/tabid/112/ctl/view/JRPP_ID/2677/mid/534/language/en-AU/Default.aspx on 8/8/2019.

Nicholson, A., Cook, W., Nowakowski, A., Littleboy, M., Ji, F., and Wightley, J. 2010. Dubbo Urban Landscape Interpretation Project Final Report. NSW Department of Environment, Climate Change and Water. 69 pp. +Appendices.

Rassam, D., and Littleboy, M., 2003. Identifying the lateral component of drainage flux on hill slopes. In Post, D. A. (ed) MODSIM 2003 International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, July 2003. ISBN: 1 74052 098 X. https://mssanz.org.au/MODSIM03/Volume_01/A04/03_Rassam.pdf.

Simunek, J., Sejna, M., Saito, H., Sakai, M., and van Genuchten, M. Th. , 2008. The Hydrus-1D Software Package for Simulating the Movement of Water, Heat, and Multiple Solutes in Variably Saturated Media, Version 4.0, HYDRUS Software Series 3. Department of Environmental Sciences, University of California Riverside, Riverside, California, USA,

Soilwater. 2018. Daisy Hill groundwater & salinity study peer review. Report on Project BSP-001-1-10 for Bourke Securities, Dubbo. 26 pp.

Soilwater. 2019. Vegetation management plan (VMP) for the Daisy Hill subdivision. Report on Project BSP-002-2-2 for Bourke Securities, Dubbo. 18 pp.

Stirzaker, R.J., Cook, F.J., and Knight, J.H., 2003. Where to plant trees on cropping land for control of dryland: some approximate solutions. Agricultural Water Management. 39:115-133.

Vaze, J., Tuteja, N.K., and Teng, J. 2004. CLASS U3M-1D. Downloaded from https://toolkit.ewater.org.au/Tools/CLASS-U3M-1D.

LIMITATIONS

The investigations described in this report identified actual conditions only at those locations where sampling occurred. This data has been interpreted and an opinion given regarding the overall physical and chemical conditions at the site.

Although the information in this report has been used to interpret conditions at the site, actual conditions may vary from those inferred, especially between sampling locations. Consequently, this report should be read with the understanding that it is a professional interpretation of conditions at the site based on a set of data. Although the data were considered representative of the site, they cannot fully define the conditions across the site.

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14 October 2019

DUBBO REGIONAL COUNCIL

Mr D Pfeiffer
Director Regions, Western
Department of Planning, Industry and Environment
PO Box 58
DUBBO NSW 2830

Dear Mr Pfeiffer

DAISY HILL PLANNING PROPOSAL - COMMENTS ON DRAFT DEVELOPMENT CONTROL PLAN

I refer to the above Planning Proposal and previous discussions and work activities in respect of the Planning Proposal and associated activities.

As previously discussed with the Department, it is unsure as to how the current draft Development Control Plan provided by the Proponent is to be progressed, given that ordinarily, Development Control Plans are prepared by Council's under Part 3 and utilised in development assessment processes under Part 4 of the Environmental Planning and Assessment Act, 1979.

This ultimately means that the subject draft Development Control Plan will form a Council Policy upon its consideration in accordance with the EP&A Act, 1979. Your written advice would be appreciated in respect of this issue.

1. Structure

Council currently has two (2) Comprehensive Development Control Plans that apply to land within the former Dubbo Local Government Area and the former Wellington Local Government Area respectively. In addition, Council also has a number of site or area specific Development Control Plans that have been prepared in accordance with Part 6 of the Dubbo Local Environmental Plan 2011 in respect of Urban Release Areas.

Given the characteristics of the proposed subdivision and the development site, it is considered that the draft Development Control Plan should be prepared following a similar structure and nature to the Urban Release Area Development Control Plans. The general structure of a site or Subdivision specific Development Control Plan is as follows:

All communications to: **CHIEF EXECUTIVE OFFICER**
ABN 53 539 070 928
PO Box 81 Dubbo NSW 2830
T (02) 6801 4000 **F** (02) 6801 4259 **E** council@dubbo.nsw.gov.au
Civic Administration Building Church St Dubbo NSW 2830
W dubbo.nsw.gov.au

Part 1 Introduction

Name and Application of this Plan
Purpose of this Plan
Statutory Context
Application of Plan
Background
Relationship to other Plans and Documents
Strategic Context
Salinity Context

Part 2 Residential Development and Subdivision

Residential Subdivision Controls (Dwelling and Dual Occupancy)
- Neighbourhood Design
- Lot Layout
- Landscaping
- Infrastructure
- Street Design and Road Hierarchy
- Stormwater Management
- Salinity

Residential Design (Dwellings and Dual Occupancy)
- Streetscape Character
- Building Setbacks
- Solar Access
- Open Space and Landscaping
- Infrastructure (water, sewer and stormwater)
- Vehicular access
- Waste Management
- Signage
- Non-Residential Uses
- Salinity

In particular, it appears that the current draft Development Control Plan has limited information in respect to the overall subdivision and development outcome for the land. Especially, given that the Development Control Plan provides limited information on building siting and design, building setbacks, heights and materials that are proposed to be used etc.

Furthermore, without this information, development proponents will find it difficult trying to understand the type of subdivision on the land and the actual development outcomes the Proponent has sought to deliver in the immediate locality.

The Residential Subdivision Controls for dwellings and dual occupancies need a specific section for Infrastructure requirements to be included, where they can be explained and quantified, to ensure the public and any future development proponents can understand the basis of infrastructure, how Council will consider the provision of various forms of infrastructure on the land and for Proponents to understand the relative cost structures associated with infrastructure.

This is particularly important given that the development Proponent has previously provided Council with information that he was seeking to provide town water to each allotment in the subdivision and the infrastructure planning and requirements associated with this item for the future.

2. Specific concerns with the draft Development Control Plan

The following table details specific issues with the draft Development Control Plan as currently drafted:

Element	Proposed Solution	Issue Identified by DRC
Element 1 – Subdivision Design P1	A1.1 Subdivision layout is consistent with DCP Masterplan	This is reversed, it is considered that the DCP has been prepared to suit the proposed Subdivision layout without consideration of the known Salinity issues.
P3	A3.1 Subdivision layout is consistent with DCP Masterplan and Vegetation Management Plan.	The VMP is dated 1 April 2019, as is the Draft DCP. Layout designs pre-date both documents. It is considered that vegetation plantings have not been designed to best mitigate Salinity impacts, both on and off site, vegetation plantings have been retro-fitted to suit the Lot Layout.
P4	A4.1 Existing dams are backfilled	Design details are required regarding the road drains. Council stormwater engineers must determine the appropriateness of the proposed lack of Stormwater mitigation. Council Engineers must address the appropriateness of road placement over areas of highest known Salinity concerns, particularly in the North and East, with specific focus on road and infrastructure longevity in the specific locations.
	A4.2 New dams are prohibited	
	A4.3 Road drains are designed to avoid large volumes of water infiltrating	
	A4.4 No stormwater detention ponds	

Element	Proposed Solution	Issue Identified by DRC
Element 2 – Landscaping P1	A1.1 Road Reserves are vegetated	It is again considered that lot layouts and road locations have been somewhat pre-planned prior to a full assessment of salinity impacts on the land.
	A1.4 Retain existing trees where practical	Given constraints of the Biodiversity Conservation Act, all woody vegetation is required to be retained unless and until a BOS entry determination is made and any potential Credit Liabilities retired.
P2	A2.1 Landscaping is undertaken using species and planting design outlined in the VMP	Given the already stated constraints it is Council's contention that the Vegetation Management Plan should be redrafted to consider current Salinity and Groundwater knowledge and the Lot Layout be re-designed to accommodate those requirements.
Element 3 – Stormwater management P1	A1.1 Subdivision road pattern is consistent with the DCP Masterplan	Again the DCP is following the road design/lot layout.
	A1.2 Road drains are designed to avoid large volumes of water infiltrating any one location	Designs require Council engineering approval in accordance with Council policy
		Council stormwater section approval of the lack of on-site stormwater detention is required. This is contrary to longstanding DRC policy.
P3	A3.1 Tables 1-5 of the Salinity Management Strategy	These tables are repetitive, inadequate and incomplete.
Element 4 – Land Use Controls P2	A2.2 Rainwater Tanks	No mention of scale of rainwater tanks is made. These must be adequate to cope with both the size and layout of the development and Dubbo's climate.

Element	Proposed Solution	Issue Identified by DRC
Unaddressed Issues	Infrastructure Integrity	Infrastructure is sited on areas of highest potential salinity (based on EM surveys). Road surface and subsurface failures are to be expected. Underground pipes and conduits may be impacted. No details of required infrastructure construction techniques are provided.
	Stormwater Retention on site	Concurrence with Council Stormwater section is required. The stated goal of moving stormwater off-site as quickly as possible is against long-standing Council Policy and may well impose unacceptable loads on downstream infrastructure.
	Water reticulation	Water is required to be reticulated to the site, no provision for water infrastructure appears to have been made. No discussion of reticulation is made within the DCP.
	Lot Layout	Lot Layout should follow the science of Salinity and groundwater and required mitigation.
	Salinity Management Strategy	The SMS must provide a set of directions that can be adequately followed by any potential future developer to reach the same result. The current document is incomplete and does not offer an adequate set of directions.
	Vegetation Management Plan	The VMP should follow the science of Salinity and groundwater and identify the required mitigation.

3. Salinity

Council's submission in respect of the overall Planning Proposal raised a number of concerns in respect of salinity on the land and downstream in the Troy Gully Catchment. In the absence of any comments or information in respect of the issues raised by Council in respect of salinity, a copy of Council's submission is attached for your information and consideration.

4. Future Direction

Following the receipt of further information in respect of the governance issues associated with the draft Development Control Plan, Council Staff are available to meet with you to discuss the issues raised in this correspondence, salinity impacts both on the land and downstream and the corresponding path for the subject Planning Proposal.

If you require any further information please contact the undersigned on (02) 6801 4000.

Yours faithfully

Steven Jennings
Manager Growth Planning

Attachment: Council's Submission